July 30, 1957

Present Status of Screw-worm Research and Plans for Eradication

Part 1--Current Research

By

R. C. Bushland, Entomology Research Division

During the past year investigations at Kerrville, Tex. and Orlando, Fla. have been conducted especially to answer questions which have a direct bearing on a future Southeastern States eradication campaign.

A. Laboratory studies

Special experiments were performed in cooperation with the Genetics Foundation of the University of Texas to obtain more definite information on the genetic and cytological effects of irradiation. The University of Texas workers found that screw-worms have six pairs of chromsomes. When five-day-old pupae were irradiated with 7,500 r of x-rays and examined ten minutes after treatment, cells in telophase showed pronounced chromosomal damage.

The dominant lethal mutations produced by 7,500 r of x-rays or gamma rays were permanently sterilizing. Male flies were provided with an abundance of virgin females with which they mated until they died of old age and they never were able to produce normal sperm as judged either by cytological observations or by egg-hatching records.

Female flies emerging from pupae irradiated with 5,000 r are sterile but a small proportion do lay a few eggs. Females flies treated with 7,500 r have been incapable of ovipositing even abnormal egg masses.

Thus it seems safe to release screw-worm flies sterilized with 7,500 r without fear of the phenomenon of temporary sterility which some workers have observed to occur with fruit flies which may regain their fertility in old age.

Irradiated flies do not live quite as long as untreated controls but there is a considerable margin between the sterilizing and the lethal dose of gamma rays. Pupae were killed by 100,000 r. There was some pupal mortality from 75,000 r and the flies which emerged died within a week. However, flies seemed to tolerate equally well a range of doses below 50,000 r.

B. Florida field test

The current field test started May 1 in cooperation with the Animal Disease Eradication Division and the Florida Livestock Board at Orlando, Fla. is still in progress and will be completed sometime in September. Day-old flies are distributed in mile swaths by aircraft, over a 2,000 square mile plot releasing 500 sterile males and 500 sterile females per square mile per week.

Results are appraised primarily on the basis of hatching records on eggs collected from wounded goats held in pens located in the treated plot and in surrounding check areas. These records are summarized in table 1.

Table 1.--

Summary of 1957 Florida screw-worm field test showing total egg masses and sterile egg masses in weekly goat pen collections.

Week ending	Check area			Release area	
	North	South	West	Center	East
5/4	11[1]-0[2]	10-0	0-0	75-0	12-0
5/11	61-1	61-0	32-0	214-10	39-3
5/18	92-4	72-0	50-4	283-15	11-0
5/25	144-2	100-1	44-4	151-15	47-11
6/1	184-10	94-1	43-1	119-5	188-45
6/8	140-1	102-3	45-1	182-18	376-72
6/15	133-2	96-2	56-0	160-14	415-104
6/22	200-0	78-0	30-0	186-47	333-133
6/29	185-3	36-2	24-1	104-26	244-103
7/6	111-4	18-0	18-0	88-24	194-79
7/13	121-1	13-0	6-0	70-28	103-46
7/20	94-3	6-0	8-4	56-35	97-74

1/ Total (fertile plus sterile) egg masses.

2/ Number of egg masses failing to hatch.

Table 1.—

Summary of 1957 Florida acre-corn field test showing total egg masses and sterile egg masses in weekly grab pan collections.

Week ending	Check area		Poisoned area	
	Total 1/	Sterile	Total	Sterile
5/4	12-0	10-0	0-0	12-0
5/11	84-3	84-0	32-0	318-10
5/18	92-4	72-0	28-0	312-12
5/25	148-2	102-1	44-0	324-16
6/1	128-10	84-1	12-1	332-9
6/8	240-1	102-1	16-1	356-10
6/15	232-0	96-0	28-0	340-14
6/22	200-0	78-0	32-0	356-17
6/29	188-3	24-0	84-1	348-24
7/6	112-4	18-0	12-0	88-14
7/13	124-1	12-0	6-0	72-10
7/20	84-3	6-0	8-4	56-12

1/ Total (fertile plus sterile) egg masses.

2/ Number of egg masses hatching to nymph.

There has been a steady decline in the number of egg masses from the treated area since early in June when screw-worm activity was at a peak. Records on pens near the center of the fly release area are as follows:

6/2-6/8--182 egg masses--10% sterile

6/9-6/15--160 egg masses--9% sterile

6/16-6/22--186 egg masses--25% sterile

6/23-6/29--104 egg masses--25% sterile

6/30-7/6--88 egg masses--27% sterile

7/7-7/13--70 egg masses--40% sterile

7/14-7/20--56 egg masses--62% sterile

Pens in the most isolated part of the test area produced as follows:

6/2-6/8--376 egg masses--19% sterile

6/9-6/15--415 egg masses--25% sterile

6/16-6/22-333 egg masses--40% sterile

6/23-6/29--244 egg masses--42% sterile

6/30-7/6--194 egg masses--41% sterile

7/7-7/13--103 egg masses-45% sterile

7/14-7/20--97 egg masses--76% sterile

There has been a considerable drift of flies from the 2,000 square mile treated area as evidenced by the collection of sterile egg masses as far as 30 miles away from the area of fly release and sterile egg masses have been common at goat pens 15 miles north of the treated area. Since there is that evident movement of flies from the treated area to check areas there is undoubtedly a similar migration into the treated area. Because the treated area cannot be isolated from this migration it is difficult to demonstrate control. However, it is obvious from the high percentage of sterile egg masses now being collected within the treated area that the release of sterile flies is effective. All of these results add weight to the evidence that release of sterilized flies will be a practical tool for screw-worm eradication.

C. Chemical control of screw-worms

At the Kerrville laboratory a new phosphorus insecticide, Bayer 21/199, has shown outstanding promise as a screw-worm treatment. This chemical is in commercial production in Germany and if our research findings continue to be borne out the chemical should be available a year from now for use in connection with a screw-worm eradication campaign. Studies with the labeled insecticide using P^{32} show that when cattle are sprayed with 0.5% of the chemical only about 6 percent of the compound is absorbed by a treated animal. The absorbed portion is rapidly eliminated leaving no residue in the muscle or fat of cattle slaughtered one week after treatment. At that time there were traces of radioactivity in liver and kidneys but the maximum was not more than a few hundredths of a part per million.

There has been a considerable drift of flies from the 2,000 square mile treated area as evidenced by the collection of sterile egg masses as far as 30 miles away from the area of fly release and sterile egg masses have been common at goat pens 15 miles north of the treated area. Since there is that evident movement of flies from the treated area to check areas there is undoubtedly a similar migration into the treated area. Because the treated area cannot be isolated from this migration it is difficult to demonstrate control. However, it is obvious from the high percentage of sterile egg masses now being collected within the treated area that the release of sterile flies is effective. All of these results add weight to the evidence that release of sterilized flies will be a practical tool for screw-worm eradication.

C. Chemical control of screw-worms

At the Kerrville laboratory a new phosphorus insecticide, Bayer 21/199, has shown outstanding promise as a screw-worm treatment. This chemical is in commercial production in Germany and if our research findings continue to be borne out the chemical should be available a year from now for use in connection with a screw-worm eradication campaign. Studies with the labeled insecticide using P^{32} show that when cattle are sprayed with 0.5% of the chemical only about 6 percent of the compound is absorbed by a treated animal. The absorbed portion is rapidly eliminated leaving no residue in the muscle or fat of cattle slaughtered one week after treatment. At that time there were traces of radioactivity in blood and kidneys but the maximum was not more than a few hundredths of a [illegible] per million.

Cattle sprayed with 0.5% of 21/199 and subsequently wounded were immune to infestation by screw-worms for as long as five weeks after treatment. Apparently enough insecticide from the deposit on the hair falls into the wound to function as a larvicide against newly hatched screw-worms. Observations on cattle treated with radioactive insecticide indicate that minute quantities of Bayer 21/199 are sufficient to kill young larvae.

Large-scale field tests involving thousands of head of cattle, sheep, and goats are now underway in Texas and under those field conditions 0.5% sprays are highly protective for at least two weeks. The sprays also kill all larvae growing in wounds at time of spraying. There have been a few cases where infestation has occurred earlier than two weeks in such wounds as those resulting from birth of young, and following surgical procedures which cause profuse bleeding. To take care of severe wounds the Kerrville laboratory is developing a new wound dressing similar to EQ-335 except that 3 percent of 21/199 is used in place of 3 percent of lindane. It is expected that this summer's field work will show that the new smear is superior to EQ-335.

Field tests have been started near Avon Park, Fort Myers, and Sarasota, Fla. to check on the performance of sprays and wound dressings applied to cattle under Florida ranch conditions.

Cattle sprayed with 0.5% of 21/199 and subsequently wounded were immune to infestation by screw-worms for as long as five weeks after treatment. Apparently enough insecticide from the deposit on the hair falls into the wound to function as a larvicide against newly hatched screw-worms. Observations on cattle treated with radioactive insecticide indicate that minute quantities of Dayer 21/199 are sufficient to kill young larvae.

Large-scale field tests involving thousands of head of cattle, sheep, and goats are now underway in Texas and under those field conditions 0.5% sprays are highly protective for at least two weeks. The spray also kill all larvae growing in wounds at time of spraying. There have been a few cases where infestation has occurred earlier than two weeks in such wounds as those resulting from birth of young, and following surgical procedures which cause profuse bleeding. To take care of severe wounds the Kerrville laboratory is developing a new wound dressing similar to EQ-335 except that 3 percent of 21/199 is used in place of 3 percent of Lindane. It is expected that this summer's field work will show that the new smear is superior to EQ-335.

Field tests have been started near Avon Park, Fort Myers, and Sarasota, Fla. to check on the performance of sprays and wound dressings applied to cattle under Florida ranch conditions.

These developments in insecticide research should be of great value in a future eradication campaign. Routine spraying of cattle being shipped into the Southeast from a screw-worm infested area may control inconspicuous infestations which might not be noticed by inspectors looking for visible wounds to treat with a dressing.

The new spray might also be of value for use by Florida ranchers to protect range cattle and to prevent screw-worm build-up in commercial herds at the start of an eradication campaign while flies are still numerous in nature. Bayer 21/199 in a wound dressing to replace lindane as now used in EQ-335 may prove more effective when used in connection with castration, earmarking, and dehorning.